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FAIRCHILD SEMICONDUCTOR™

October 2001
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74ALVCH16373
Low Voltage 16-Bit Transparent Latch with Bushold

General Description

The ALVCH16373 contains sixteen non-inverting latches with 3-STATE outputs and is intended for bus oriented applications. The device is byte controlled. The flip-flops appear to be transparent to the data when the Latch Enable (LE) is HIGH. When LE is LOW, the data that meets the setup time is latched. Data appears on the bus when the Output Enable ($\overline{OE}$) is LOW. When $\overline{OE}$ is HIGH, the outputs are in a high impedance state.

The ALVCH16373 data inputs include active bushold circuitry, eliminating the need for external pull-up resistors to hold unused or floating data inputs at a valid logic level.

The 74ALVCH16373 is designed for low voltage (1.65V to 3.6V) V_{CC} applications with output compatibility up to 3.6V.

The 74ALVCH16373 is fabricated with an advanced CMOS technology to achieve high speed operation while maintaining low CMOS power dissipation.

Features

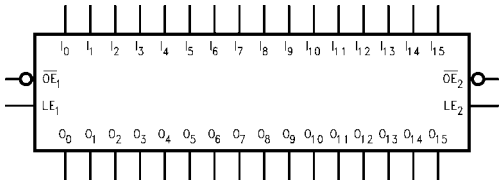
- 1.65V to 3.6V V_{CC} supply operation
- 3.6V tolerant control inputs and outputs
- Bushold on data inputs eliminates the need for external pull-up/pull-down resistors
- t_{PD} (I_n to O_n)
  - 3.6 ns max for 3.0V to 3.6V V_{CC}
  - 4.5 ns max for 2.3V to 2.7V V_{CC}
  - 6.8 ns max for 1.65V to 1.95V V_{CC}
- Uses patented noise/EMI reduction circuitry
- Latch-up conforms to JEDEC JED78
- ESD performance:
  - Human body model > 2000V
  - Machine model > 200V

Ordering Code:

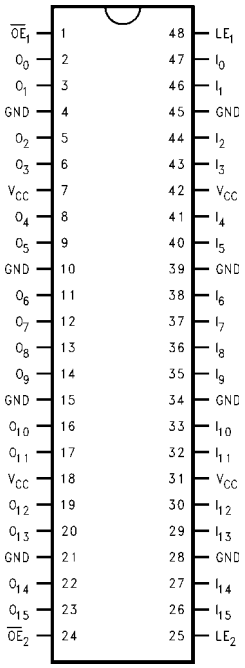
Order Number	Package Number	Package Description
74ALVCH16373T	MTD48	48-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 6.1mm Wide

Devices also available in Tape and Reel. Specify by appending suffix letter "X" to the ordering code.

Logic Symbol



Connection Diagram



Pin Descriptions

Pin Names	Description
$\overline{OE}_n$	Output Enable Input (Active LOW)
LE_n	Latch Enable Input
I_0–I_{15}	Bushold Inputs
O_0–O_{15}	Outputs
NC	No Connect

Truth Tables

Inputs			Outputs
LE_1	$\overline{OE}_1$	I_0–I_7	O_0–O_7
X	H	X	Z
H	L	L	L
H	L	H	H
L	L	X	O_0

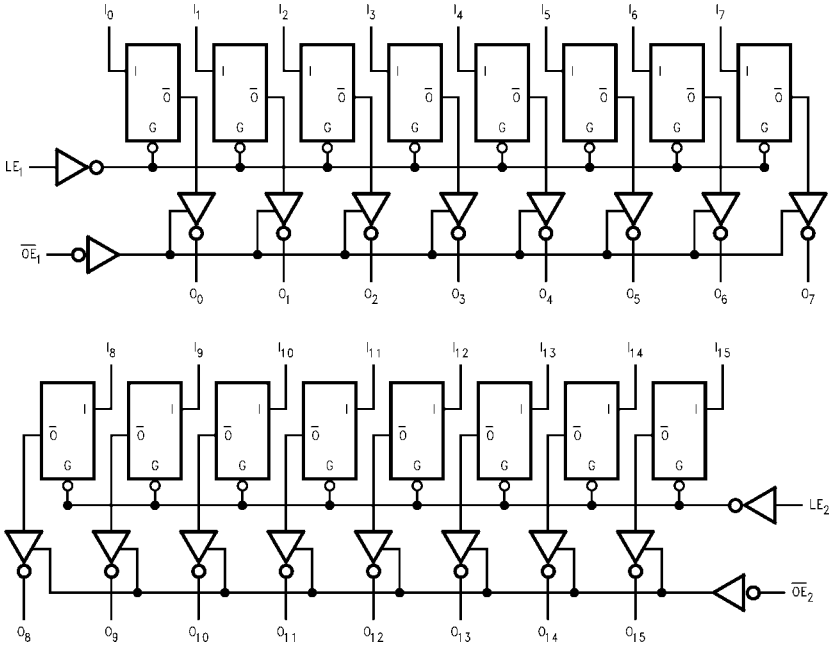
Inputs			Outputs
LE_2	$\overline{OE}_2$	I_8–I_{15}	O_8–O_{15}
X	H	X	Z
H	L	L	L
H	L	H	H
L	L	X	O_0

H = HIGH Voltage Level
L = LOW Voltage Level
X = Immaterial (HIGH or LOW, control inputs may not float)
Z = High Impedance
O_0 = Previous O_0 before HIGH-to-LOW of Latch Enable

Functional Description

The 74ALVCH16373 contains sixteen edge D-type latches with 3-STATE outputs. The device is byte controlled with each byte functioning identically, but independent of the other. Control pins can be shorted together to obtain full 16-bit operation. The following description applies to each byte. When the Latch Enable (LE_n) input is HIGH, data on the I_n enters the latches. In this condition the latches are transparent, i.e., a latch output will change state each time its I input changes. When LE_n is LOW, the latches store information that was present on the I inputs a setup time preceding the HIGH-to-LOW transition on LE_n. The 3-STATE outputs are controlled by the Output Enable ($\overline{OE}_n$) input. When $\overline{OE}_n$ is LOW the standard outputs are in the 2-state mode. When $\overline{OE}_n$ is HIGH, the standard outputs are in the high impedance mode but this does not interfere with entering new data into the latches.

Logic Diagram



Please note that this diagram is provided only for the understanding of logic operations and should not be used to estimate propagation delays.

Absolute Maximum Ratings(Note 1)

Supply Voltage (V_{CC})	−0.5V to +4.6V
DC Input Voltage (V_I)	−0.5V to 4.6V
Output Voltage (V_O) (Note 2)	−0.5V to V_{CC} +0.5V
DC Input Diode Current (I_{IK})	
V_I < 0V	−50 mA
DC Output Diode Current (I_{OK})	
V_O < 0V	−50 mA
DC Output Source/Sink Current	
(I_{OH}/I_{OL})	±50 mA
DC V_{CC} or GND Current per	
Supply Pin (I_{CC} or GND)	±100 mA
Storage Temperature Range (T_{STG})	−65°C to +150°C

Recommended Operating Conditions (Note 3)

Power Supply	
Operating	1.65V to 3.6V
Input Voltage (V_I)	0V to V_{CC}
Output Voltage (V_O)	0V to V_{CC}
Free Air Operating Temperature (T_A)	−40°C to +85°C
Minimum Input Edge Rate ($\Delta t/\Delta V$)	
V_{IN} = 0.8V to 2.0V, V_{CC} = 3.0V	10 ns/V

Note 1: The Absolute Maximum Ratings are those values beyond which the safety of the device cannot be guaranteed. The device should not be operated at these limits. The parametric values defined in the Electrical Characteristics tables are not guaranteed at the Absolute Maximum Ratings. The "Recommended Operating Conditions" table will define the conditions for actual device operation.

Note 2: I_O Absolute Maximum Rating must be observed.

Note 3: Floating or unused inputs must be held HIGH or LOW.

DC Electrical Characteristics

Symbol	Parameter	Conditions	V_{CC} (V)	Min	Max	Units
V_{IH}	HIGH Level Input Voltage		1.65 -1.95	0.65 x V_{CC}		V
			2.3 - 2.7	1.7		
			2.7 - 3.6	2.0		
V_{IL}	LOW Level Input Voltage		1.65 -1.95		0.35 x V_{CC}	V
			2.3 - 2.7		0.7	
			2.7 - 3.6		0.8	
V_{OH}	HIGH Level Output Voltage	I_{OH} = −100 µA	1.65 - 3.6	V_{CC} - 0.2		V
		I_{OH} = −4 mA	1.65	1.2		
		I_{OH} = −6 mA	2.3	2		
		I_{OH} = −12 mA	2.3	1.7		
			2.7	2.2		
			3.0	2.4		
		I_{OH} = −24 mA	3.0	2		
V_{OL}	LOW Level Output Voltage	I_{OL} = 100 µA	1.65 - 3.6		0.2	V
		I_{OL} = 4 mA	1.65		0.45	
		I_{OL} = 6 mA	2.3		0.4	
		I_{OL} = 12mA	2.3		0.7	
			2.7		0.4	
		I_{OL} = 24 mA	3		0.55	
I_I	Input Leakage Current	0 ≤ V_I ≤ 3.6V	3.6		±5.0	µA
$I_{I(HOLD)}$	Bushold Input Minimum	V_{IN} = 0.58V	1.65	25		µA
	Drive Hold Current	V_{IN} = 1.07V	1.65	−25		
		V_{IN} = 0.7V	2.3	45		
		V_{IN} = 1.7V	2.3	−45		
		V_{IN} = 0.8V	3.0	75		
		V_{IN} = 2.0V	3.0	−75		
		0 < V_O ≤ 3.6V	3.6		±500	
I_{OZ}	3-STATE Output Leakage	0 ≤ V_O ≤ 3.6V	3.6		±10	µA
I_{CC}	Quiescent Supply Current	V_I = V_{CC} or GND, I_O = 0	3.6		40	µA
ΔI_{CC}	Increase in I_{CC} per Input	V_{IH} = V_{CC} − 0.6V	3 -3.6		750	µA

AC Electrical Characteristics

Symbol	Parameter	$T_A = -40°C$ to $+85°C$, $R_L = 500\Omega$								Units
		$C_L = 50$ pF				$C_L = 30$ pF				
		$V_{CC} = 3.3V \pm 0.3V$		$V_{CC} = 2.7V$		$V_{CC} = 2.5V \pm 0.2V$		$V_{CC} = 1.8V \pm 0.15V$		
		Min	Max	Min	Max	Min	Max	Min	Max	
t_W	Pulse Width	3.3		3.3		3.3		4.0		ns
t_S	Setup Time	1.1		1		1		2.5		ns
t_H	Hold Time	1.4		1.7		1.5		1.0		ns
t_{PHL}, t_{PLH}	Propagation Delay I_n to O_n	1.1	3.6		4.3	1	4.5	1.5	6.8	ns
t_{PHL}, t_{PLH}	Propagation Delay LE to O_n	1	3.9		4.6	1	4.9	1.5	7.8	ns
t_{PZL}, t_{PZH}	Output Enable Time	1.0	4.7		5.7	1.0	6.0	1.5	9.2	ns
t_{PLZ}, t_{PHZ}	Output Disable Time	1.4	4.1		4.5	1.2	5.1	1.5	6.8	ns

Capacitance

Symbol	Parameter		Conditions	$T_A = +25°C$		Units
				V_{CC}	Typical	
C_{IN}	Input Capacitance	Control	$V_I = 0V$ or V_{CC}	3.3	3	pF
		Data	$V_I = 0V$ or V_{CC}	3.3	6	
C_{OUT}	Output Capacitance		$V_I = 0V$ or V_{CC}	3.3	7	pF
C_{PD}	Power Dissipation Capacitance	Outputs Enabled	f = 10 MHz, $C_L = 50$ pF	3.3	22	pF
				2.5	19	
		Outputs Disabled	f = 10 MHz, $C_L = 50$ pF	3.3	5	
				2.5	4	

AC Loading and Waveforms

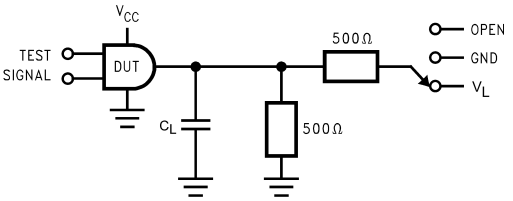


FIGURE 1. AC Test Circuit

TABLE 1. Values for Figure 1

TEST	SWITCH
t_{PLH}, t_{PHL}	Open
t_{PZL}, t_{PLZ}	V_L
t_{PZH}, t_{PHZ}	GND

TABLE 2. Variable Matrix
(Input Characteristics: f = 1MHz; $t_r = t_f$ = 2ns; Z_0 = 50Ω)

Symbol	V_{CC}			
	3.3V ± 0.3V	2.7V	2.5V ± 0.2V	1.8V ± 0.15V
V_{mi}	1.5V	1.5V	$V_{CC}/2$	$V_{CC}/2$
V_{mo}	1.5V	1.5V	$V_{CC}/2$	$V_{CC}/2$
V_X	V_{OL} + 0.3V	V_{OL} + 0.3V	V_{OL} + 0.15V	V_{OL} + 0.15V
V_Y	V_{OH} − 0.3V	V_{OH} − 0.3V	V_{OH} − 0.15V	V_{OH} − 0.15V
V_L	6V	6V	V_{CC}*2	V_{CC}*2

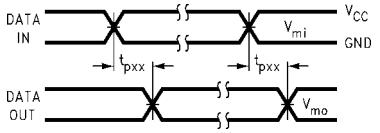


FIGURE 2. Waveform for Inverting and Non-Inverting Functions

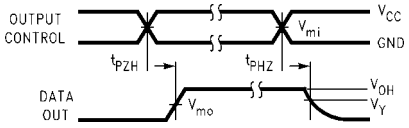


FIGURE 3. 3-STATE Output HIGH Enable and Disable Times for Low Voltage Logic

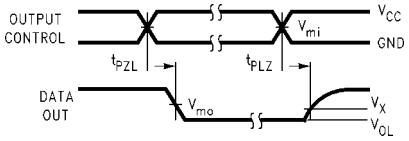


FIGURE 4. 3-STATE Output LOW Enable and Disable Times for Low Voltage Logic

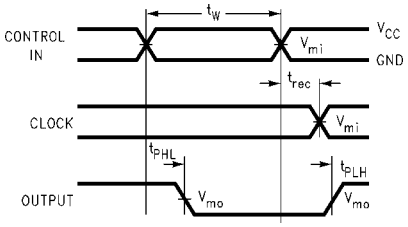


FIGURE 5. Propagation Delay, Pulse Width and t_{REC} Waveforms

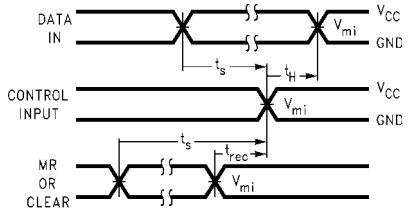
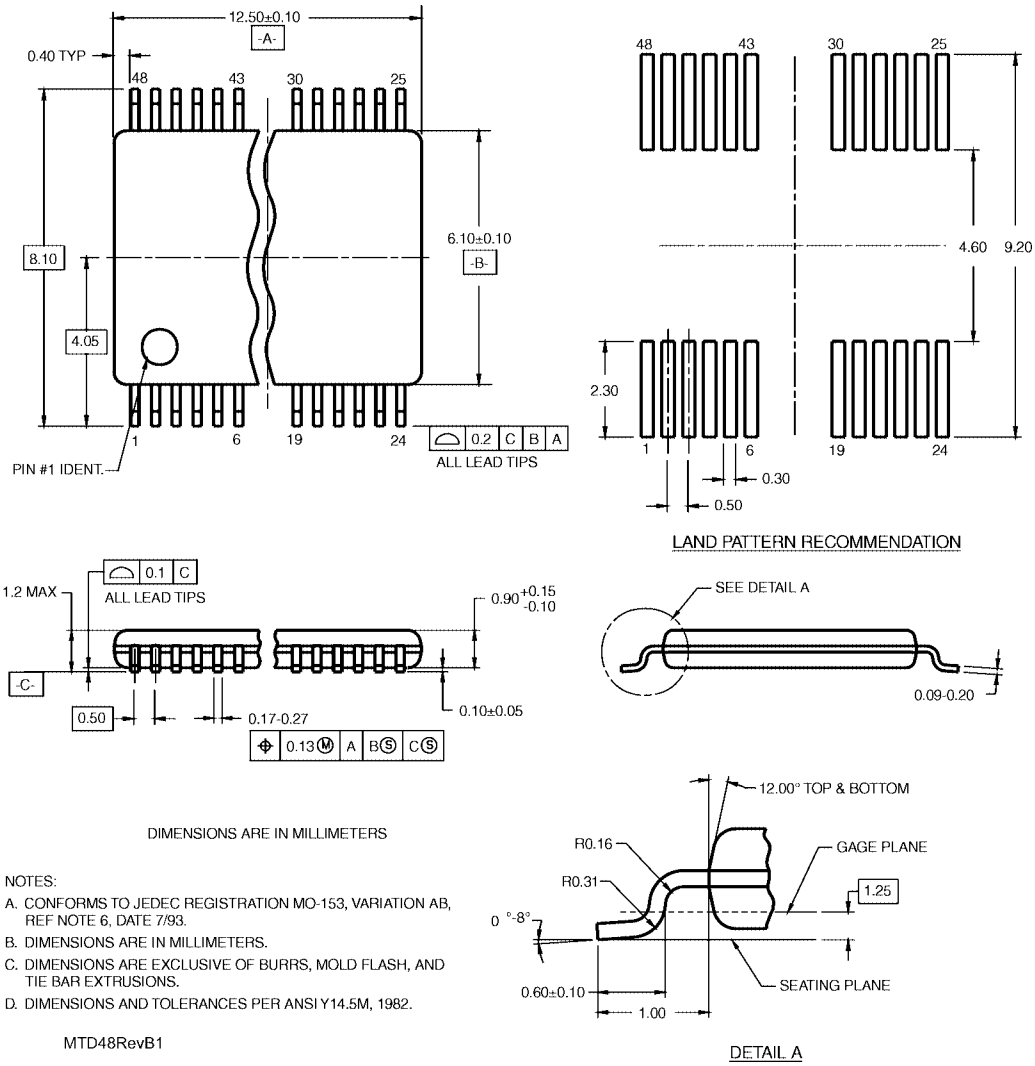


FIGURE 6. Setup Time, Hold Time and Recovery Time for Low Voltage Logic

Physical Dimensions inches (millimeters) unless otherwise noted



DIMENSIONS ARE IN MILLIMETERS

NOTES:

A. CONFORMS TO JEDEC REGISTRATION MO-153, VARIATION AB, REF NOTE 6, DATE 7/93.

B. DIMENSIONS ARE IN MILLIMETERS.

C. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSIONS.

D. DIMENSIONS AND TOLERANCES PER ANSI Y14.5M, 1982.

MTD48RevB1

48-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 6.1mm Wide
Package Number MTD48

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